



**NOAA
FISHERIES**

**Agenda Item
7.5**

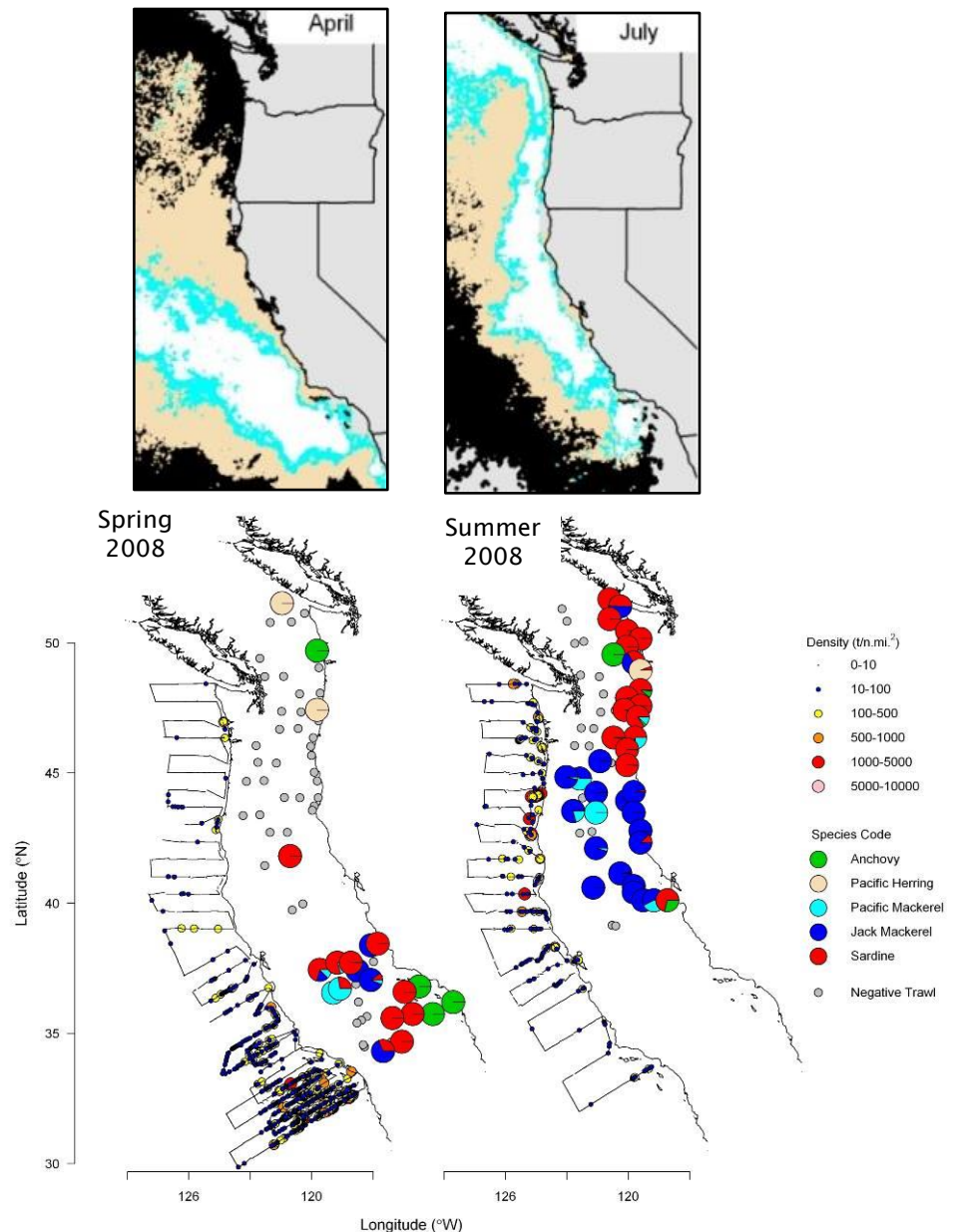
SaKe Surveys

Transboundary, Cooperative Surveys of
Sardine, Hake, other species of fish, and
zooplankton

David A. Demer

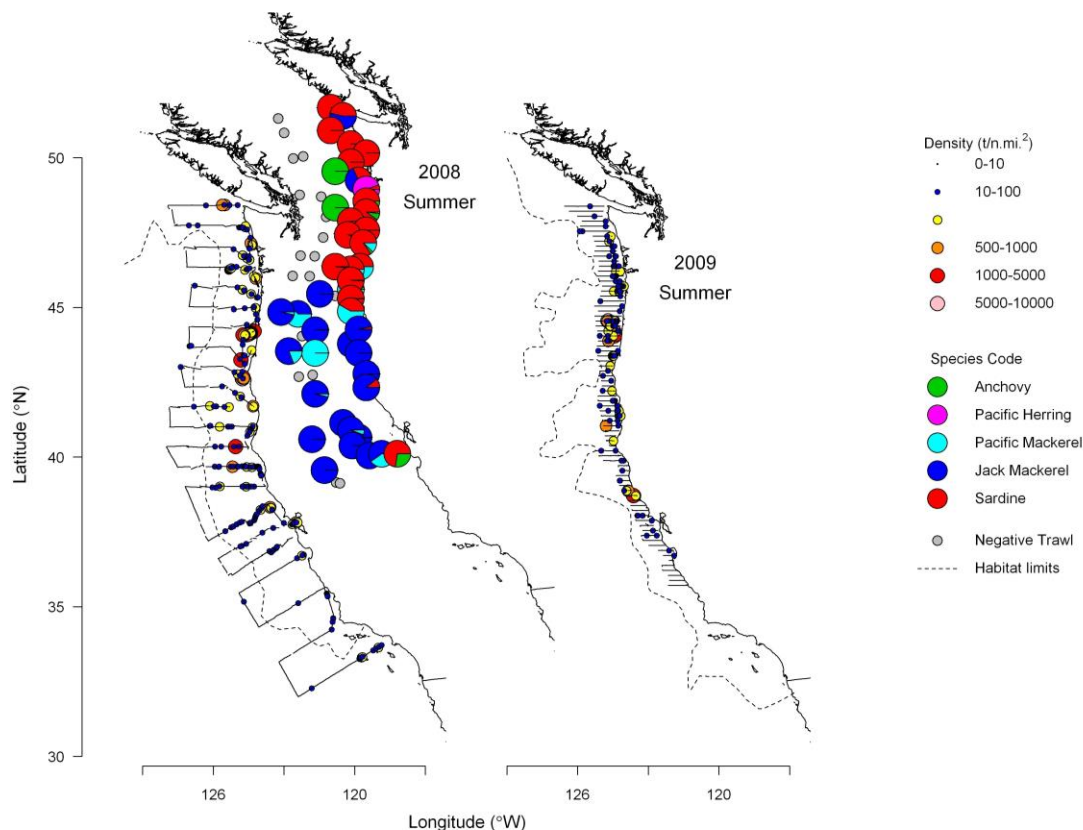
Rationale

- Sardine and hake migrate seasonally
 - Predicted by potential habitat
- Spring (April / May)
 - Sardine offshore
 - Southern and Central California
 - Peak spawning
 - Synergy with DEPM & CalCOFI surveys
- Summer (July / August)
 - Sardine nearshore
 - Constricted by high-*T* / low-*Chl-a* front
 - Northern CA, OR, WA, and VI
 - CPS more separated
 - Longer days and relatively good weather
 - Efficient multiple-species surveys



SaKe Surveys – Pilot Investigations

- Summer (July / August)
 - Sardine north and nearshore
 - Synergy with hake survey
 - Overlap with trawl survey
 - Overlap with aerial survey
 - Proximate to salmon and CalCOFI surveys
 - Efficient multiple-species surveys



SaKe Survey – Protocols

- Daytime
 - 10 nmi-spaced parallel transects
 - Nominally 9 kts
 - Longer of 35 nm or to 1500 m depth
 - Nearshore as navigable (~40 m depth or 2 km from shore)
 - Aleutian Wing Trawl, targeting Hake (~2-3 /day)
- Nighttime
 - Nordic 264 surface trawl for CPS species and lengths (~ 3 / night)
 - CTD, Bongo and Calvet samples



SaKe 2012 Survey

FSV *Bell M. Shimada*

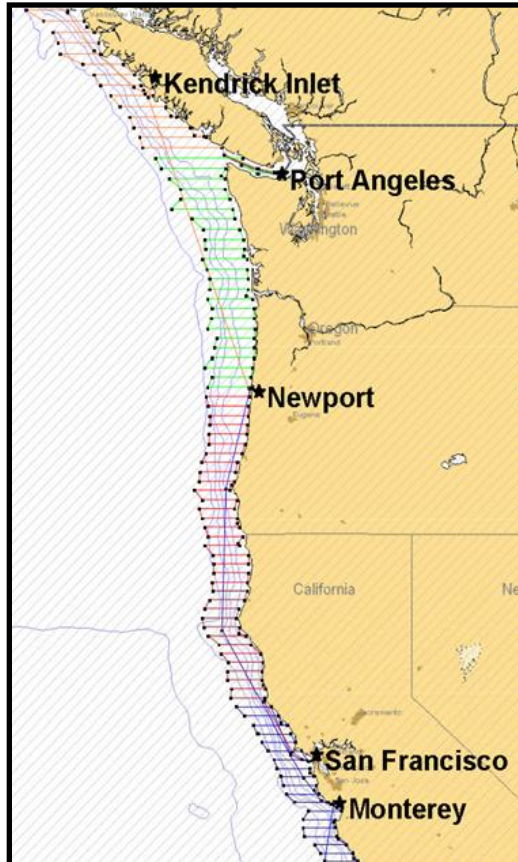
Shimada SaKe Summer Survey 2012

Leg I: Newport to San Francisco
June 24 to July 6 (13 DAS)
(blue)

Leg II: San Francisco to Newport
July 9 to July 25 (17 DAS)
(red)

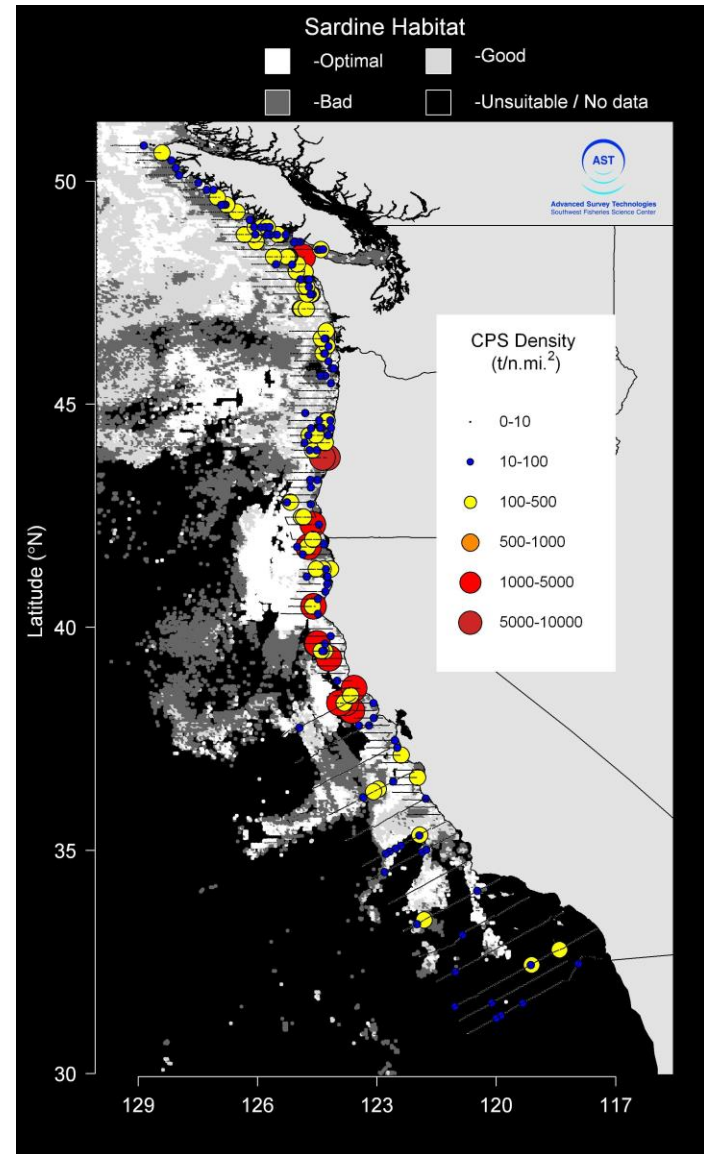
Leg III: Newport to Port Angeles
July 30 to August 12 (14 DAS)
(green)

Leg IV: Port Angeles to Newport
August 15 to August 30 (16 DAS)
(orange)



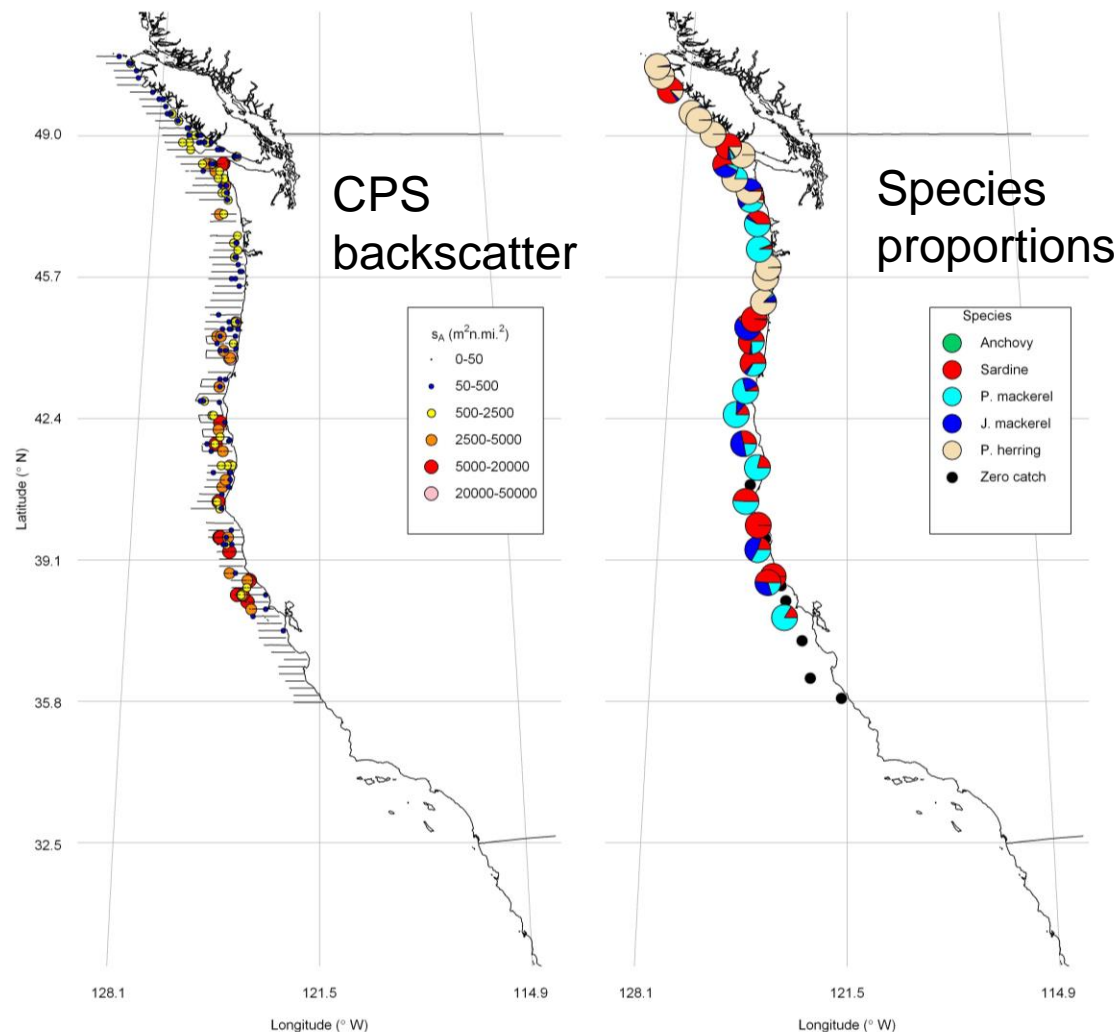
SaKe 2012 – Sampling

- 25 Jun–24 Aug 2012
- ~60 seadays
- Piedras Blancas to Vancouver Island
- 85 E-W transects
- 10-nm spacing
- 40–1500 m or 35 nm
- 3,632 nm
- 39,614 nm²
- Spanned northern stock distribution



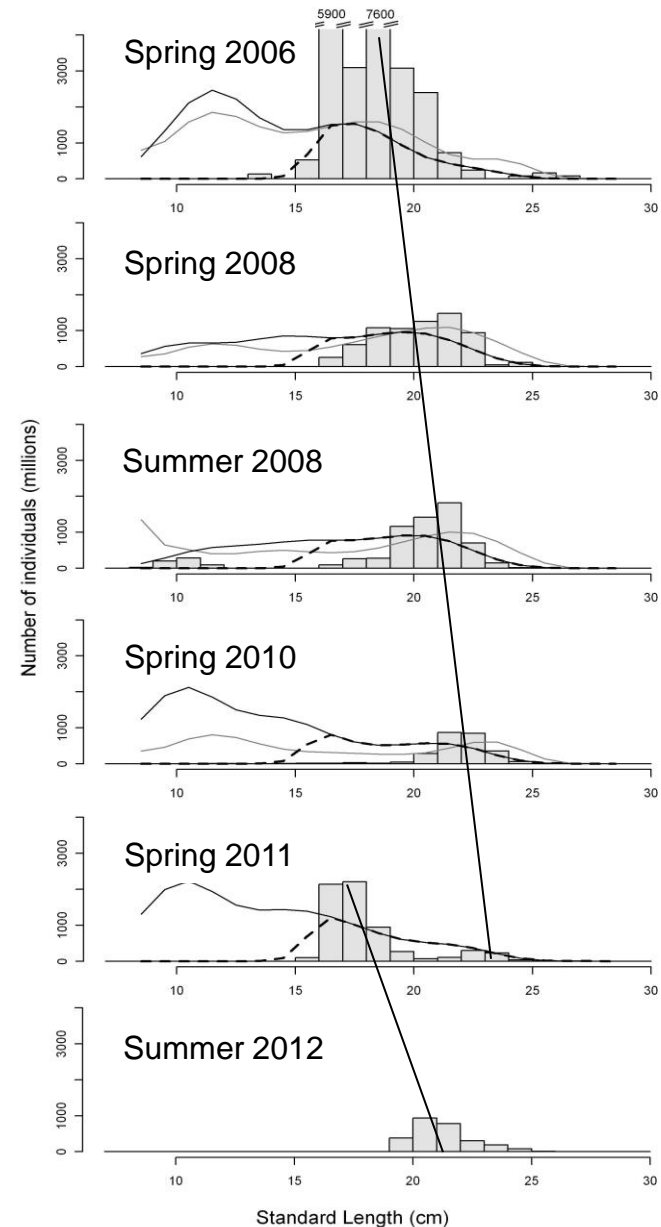
Summer 2012 ATM Processing

- CPS backscatter
 - Spectral match
 - < 70 m depth
- Trawl samples
 - 98 trawls
 - 31 CPS clusters
 - Backscatter to species
 - Sardine biomass to lengths



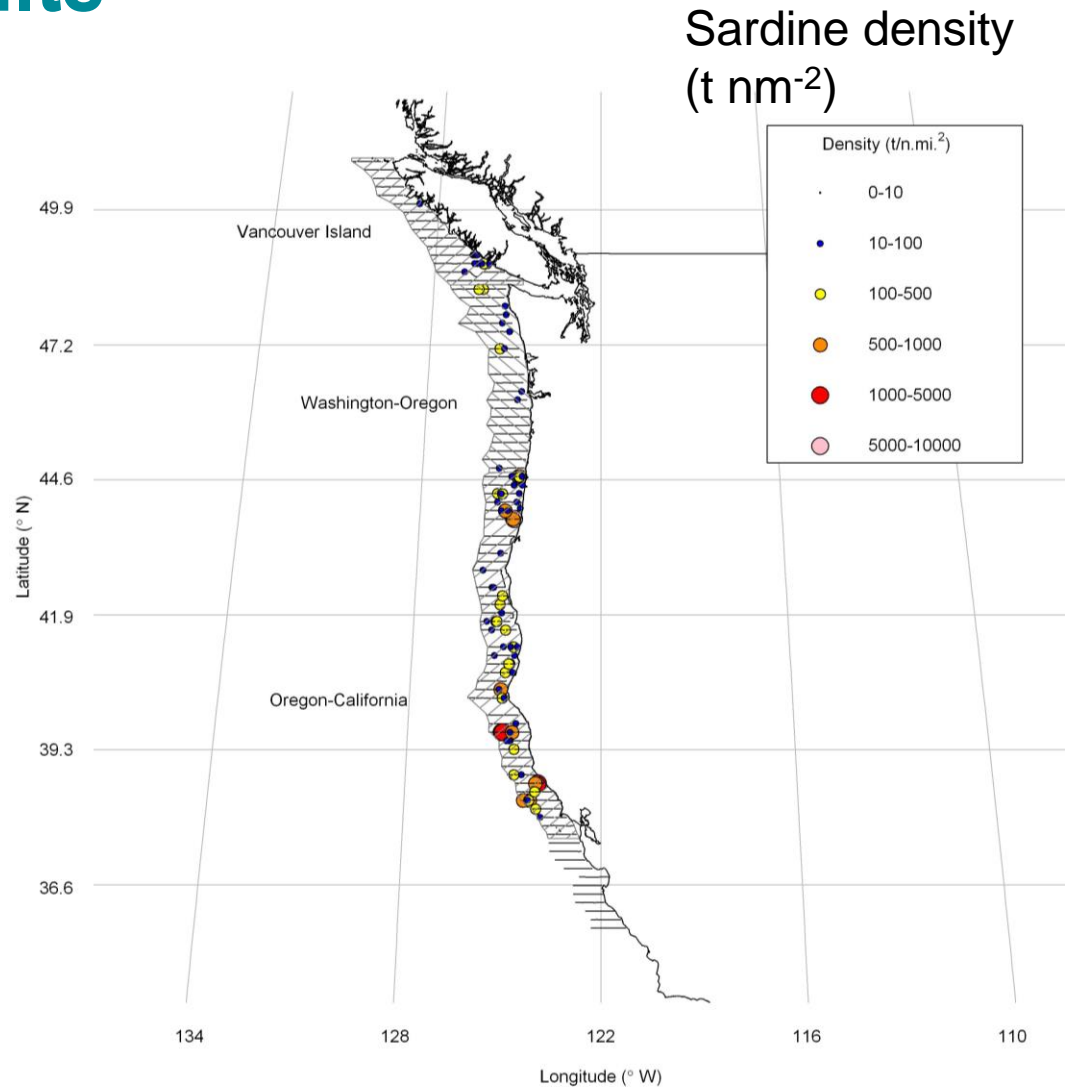
SaKe 2012 – Results

- Sardine lengths
 - Mode SL~21 cm
 - 2009-2010 cohort
 - Decline from natural and fishing mortalities
- No new cohort



SaKe 2012 – Results

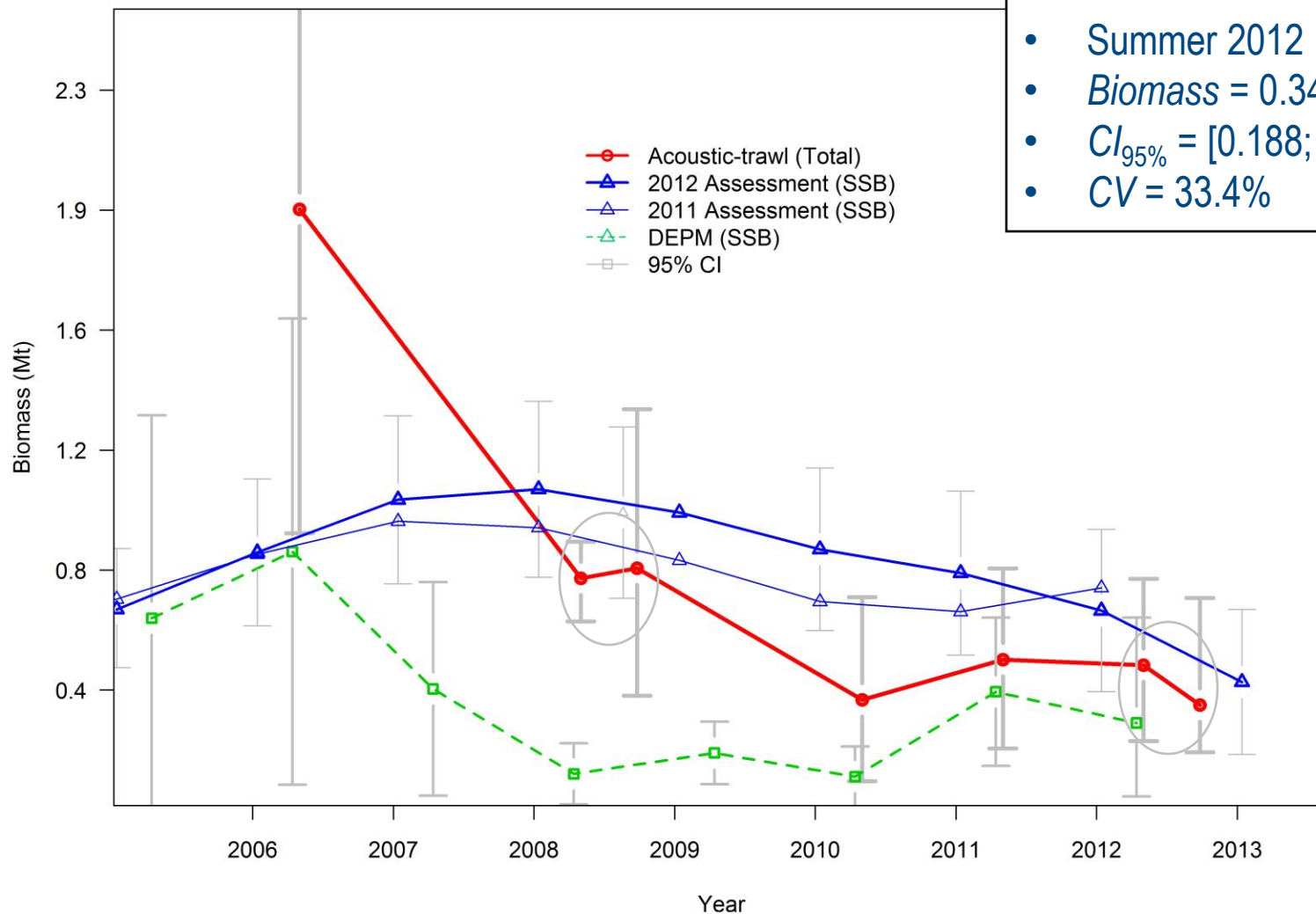
- Sardine distribution:
 - Vancouver Island
 - Washington-Oregon
 - Oregon-California
 - ~ 91% (0.309 Mt)



SaKe 2012 – Results

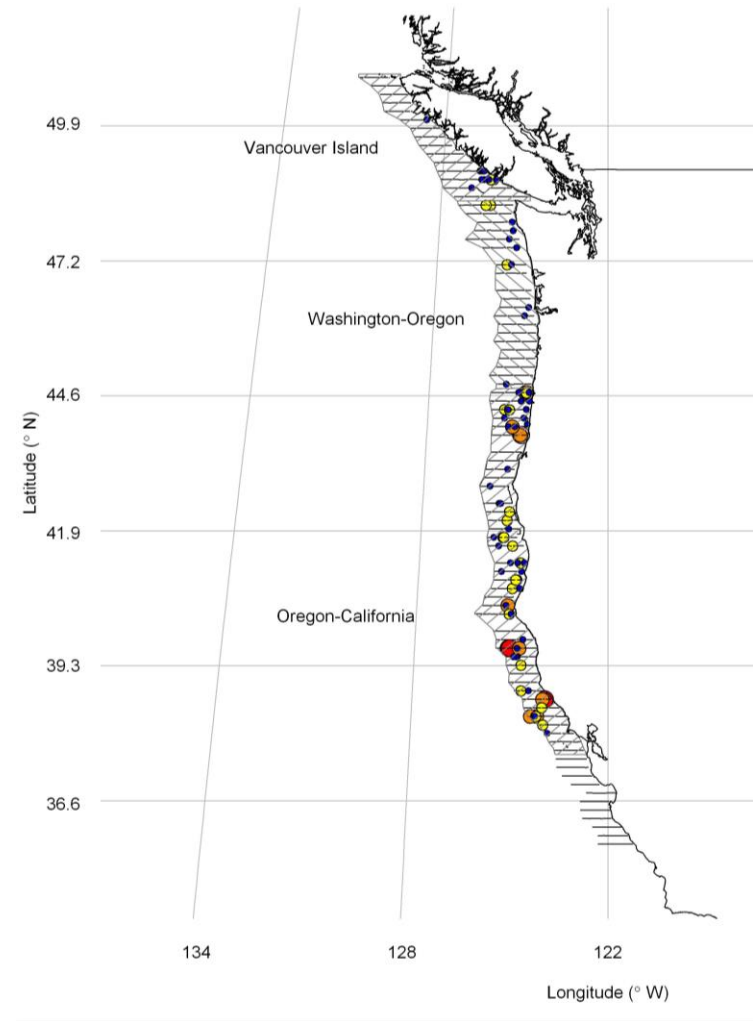
Northern Stock Sardine

- Summer 2012
- *Biomass* = 0.341 Mt
- $CI_{95\%} = [0.188; 0.688 \text{ Mt}]$
- $CV = 33.4\%$



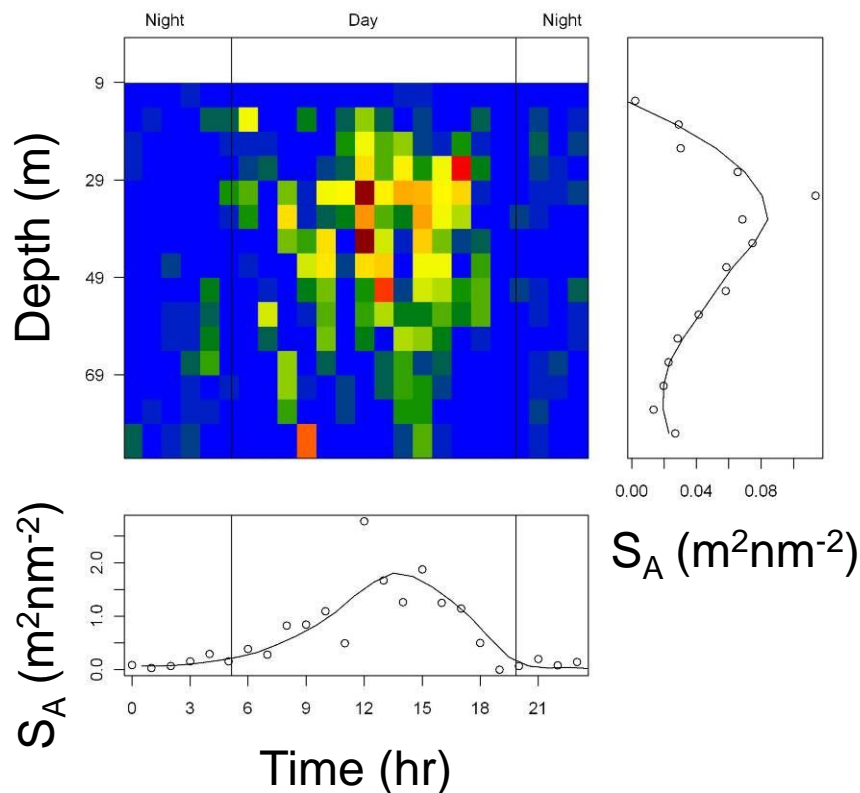
SaKe Surveys – Strengths

- Multi-species observations
- Precise, accurate, and efficient
 - Transects closely spaced
 - Transects span sardine stock
 - Synergistic or proximate surveys
 - Aerial
 - Hake
 - Salmon
 - CalCOFI
 - DEPM

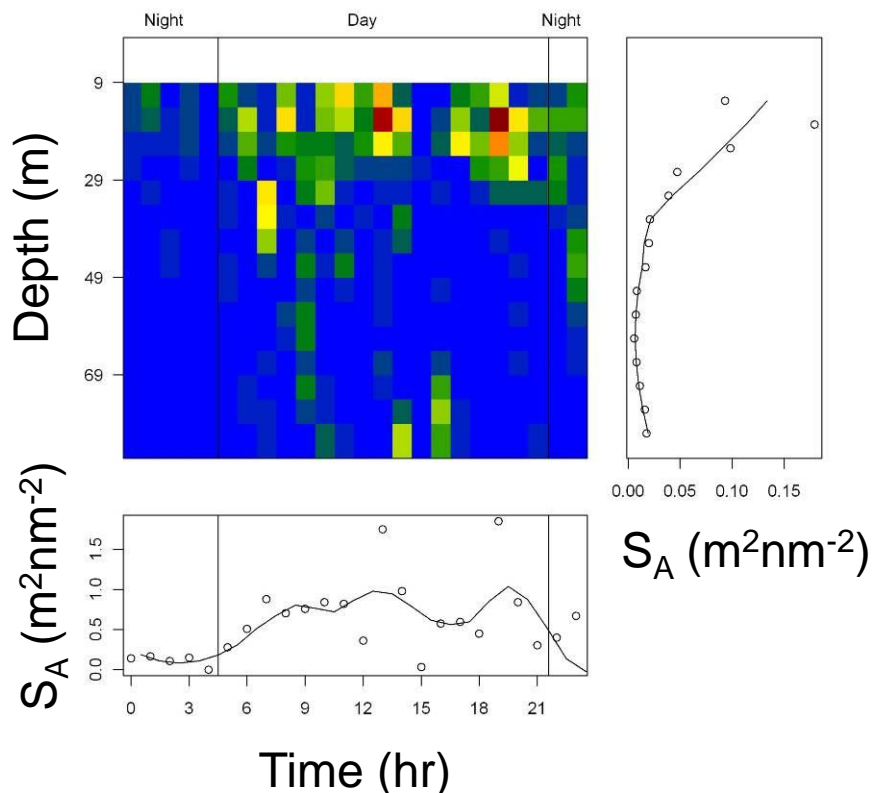


SaKe Surveys – Challenges

Spring 2008



Summer 2008



- Near-surface observations
- Nearshore observations

SaKe Surveys – Challenges



- Synoptic sampling
- Southern California sampling
- Ecosystem sampling
- More candidate species
 - Species identification
 - Target strength estimation
- Data analysis
- Data archive
- Reporting

SaKe Surveys – Strategies for Improvement

- Sample the SCB and nearshore
- Sample with scanning, multi-beam and 3-D imaging sonars
- Survey concurrently with 2 ships
- Sample optically underway
- Incorporate fishery data
- Telemeter acoustic data
- Automate data processing, reporting, and archiving

